

# **SR 99 Deep Bored Tunnel Design-Build Contract and Engineering Challenges**

**SEATTLE CITY COUNCIL  
PRESENTATION  
July 12, 2010**

# Overview

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- ◉ There are inherent risks in complex projects and particularly in underground construction
- ◉ These risks can lead to cost overruns
- ◉ Our evaluation has focused on tunneling risks
- ◉ WSDOT is doing the right things to address and manage the risks

# SR 99 Tunneling Challenges

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- ◉ Largest diameter Tunnel Boring Machine (TBM)
- ◉ Dense urban setting
- ◉ “Soft Ground”
- ◉ Abrasion
- ◉ Major risks – Settlement and TBM wear

# Cost Estimate and Budget

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- History of cost overruns on megaprojects (Flyvbjerg Study)
- Cost Estimate Evaluation Process (CEVP) addresses major risks and probability of occurrence
- Range of CEVP projected costs will narrow when bids are presented to WSDOT

# Unanticipated Conditions

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- ◉ Differing Site Conditions – major source of change orders
- ◉ WSDOT performed extensive geotechnical and environmental investigations
- ◉ Geotechnical Baseline Report for bid
- ◉ Baseline puts a lot of risk on the contractor
- ◉ Use of Design-Build provides unique opportunity for the project team to review geotech assumptions and associated design considerations

# Deformation and Settlement

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- ◉ All subsurface excavation will cause some settlement
- ◉ Results from normal and 'sub-optimum' operation of TBMs
- ◉ Highest risks are in the first ~1,500 feet of tunneling

# Deformation and Settlement

## *(cont.)*

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- ⦿ Clear demarcation between WSDOT and contractor responsibility
- ⦿ Thorough studies of structures and utilities; requirements for ground improvement and replacement
- ⦿ Thorough technical requirements for control, monitoring, and mitigation

# TBM Maintenance

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- ◉ Wear and damage to cutterhead is the primary cause of slow or delayed TBM progress
- ◉ Keys to control are appropriate conditioners, routine maintenance, TBM flexibility
- ◉ WSDOT has specified minimum 60 days of interventions
- ◉ WSDOT has right to require that inspection and maintenance be performed



# Construction Management

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- ◉ Diligence is required in monitoring and enforcement
- ◉ WSDOT will retain technical experts to assist with TBM operation tracking
- ◉ WSDOT requires task forces, particularly settlement monitoring
- ◉ Dispute resolution process follows best practices

# Design – Build Contract

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- Overall, the proposed Design-Build Contract is consistent with good contracting practice on projects of this magnitude and complexity
- The City is an Indemnified Party and Additional Insured
- Some provisions arguably are less strict than what is allowed pursuant to current law/precedent (e.g., notice of claims/changes, representations, indemnity, waivers, etc.), but can be justified given the nature of the project, the design-build approach and the overall project delivery methodology
- The significance of many of these items also can be minimized or negated through diligent project administration/supervision and communication

# Comparing Sound Transit and WSDOT in Approach to Project Risk

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## Similarities – “Standard Practices”

### ***Contractor Responsibilities***

- ◉ Delivery on schedule and within contract price
- ◉ Inflation
- ◉ Performance bond
- ◉ Damage from settlement beyond contract specifications
- ◉ Construction permits

### ***Agency Responsibilities***

- ◉ Right-of-way acquisition
- ◉ Differing site conditions
- ◉ Undisclosed contaminated soils
- ◉ Environmental review and permitting

# Sound Transit / WSDOT Comparison (cont.)

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## Differences

### ***Design/Build versus Design/Bid/Build***

- ◉ With design/build, contractor is responsible for design and developing construction methods consistent with design
- ◉ Potential for more efficient design and avoiding contract claims related to design issues

### ***Level of Prescription in Tech. Specification and Requirements***

- ◉ WSDOT's design/build approach includes very detailed specifications and requirements

### ***Approach to Insurance***

- ◉ Contractor purchased vs. owner controlled
- ◉ Types and limits similar

# **Summary of Review to Date**

## **Issues Discussed:**

### ***Project funding***

- ◉ City costs and needs for additional revenue sources for debt service
- ◉ Context of overall City capital needs

### ***Overall structure and content of agreements***

- ◉ SDOT agreement
- ◉ SCL agreement
- ◉ SPU agreement
- ◉ WSDOT RFP and draft contract

### ***Insurance, bonds and contingencies***

- ◉ General description
- ◉ Specific review of contract terms and current project budget

### ***Engineering and contracting approach***

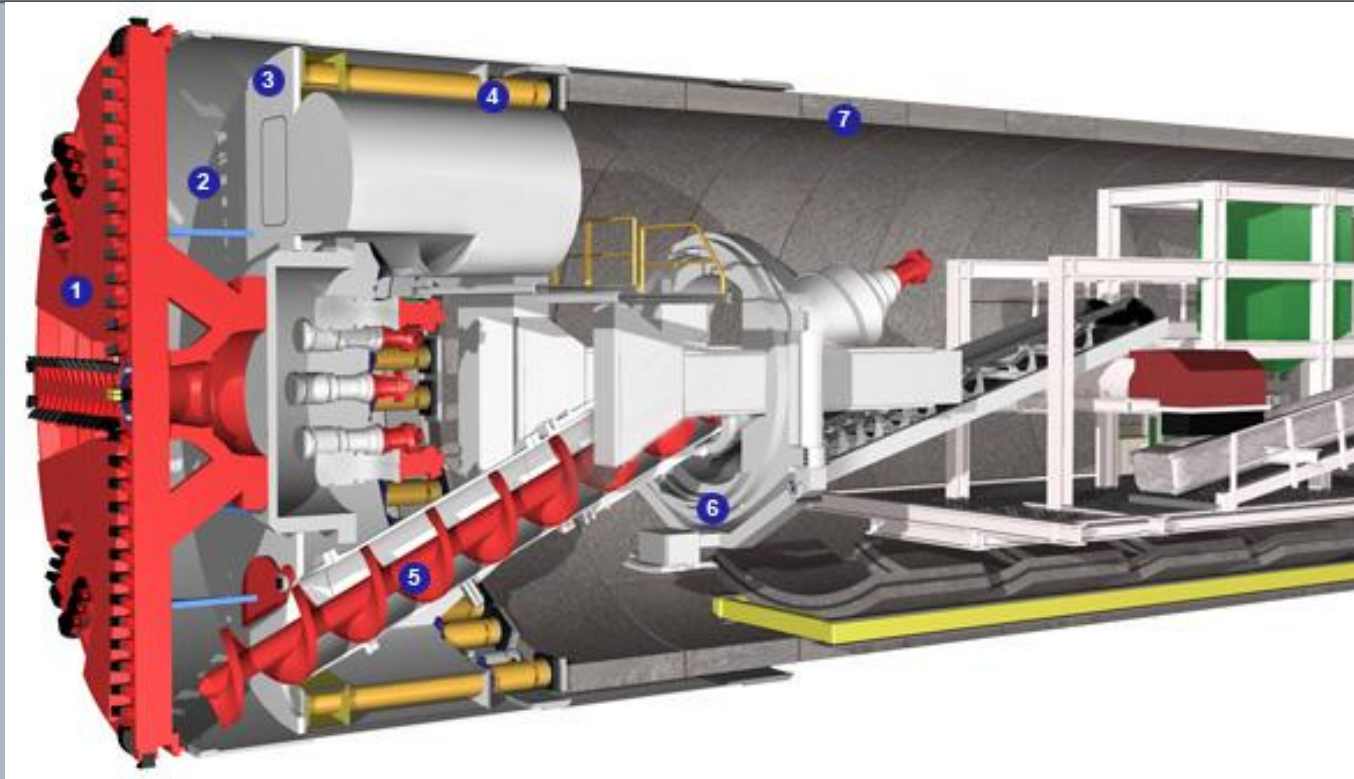
- ◉ Focus of today's discussion

## **Issues Outstanding:**

- ◉ Transit
- ◉ Traffic impacts and potential mitigation
- ◉ Life/safety issues within tunnel

# Earth Pressure Balance TBM

(Herrenknecht, 2010)



1. Cutterhead

2. Excavation Chamber

3. Bulkhead

4. Thrust Jacks

5. Conveyor Screw

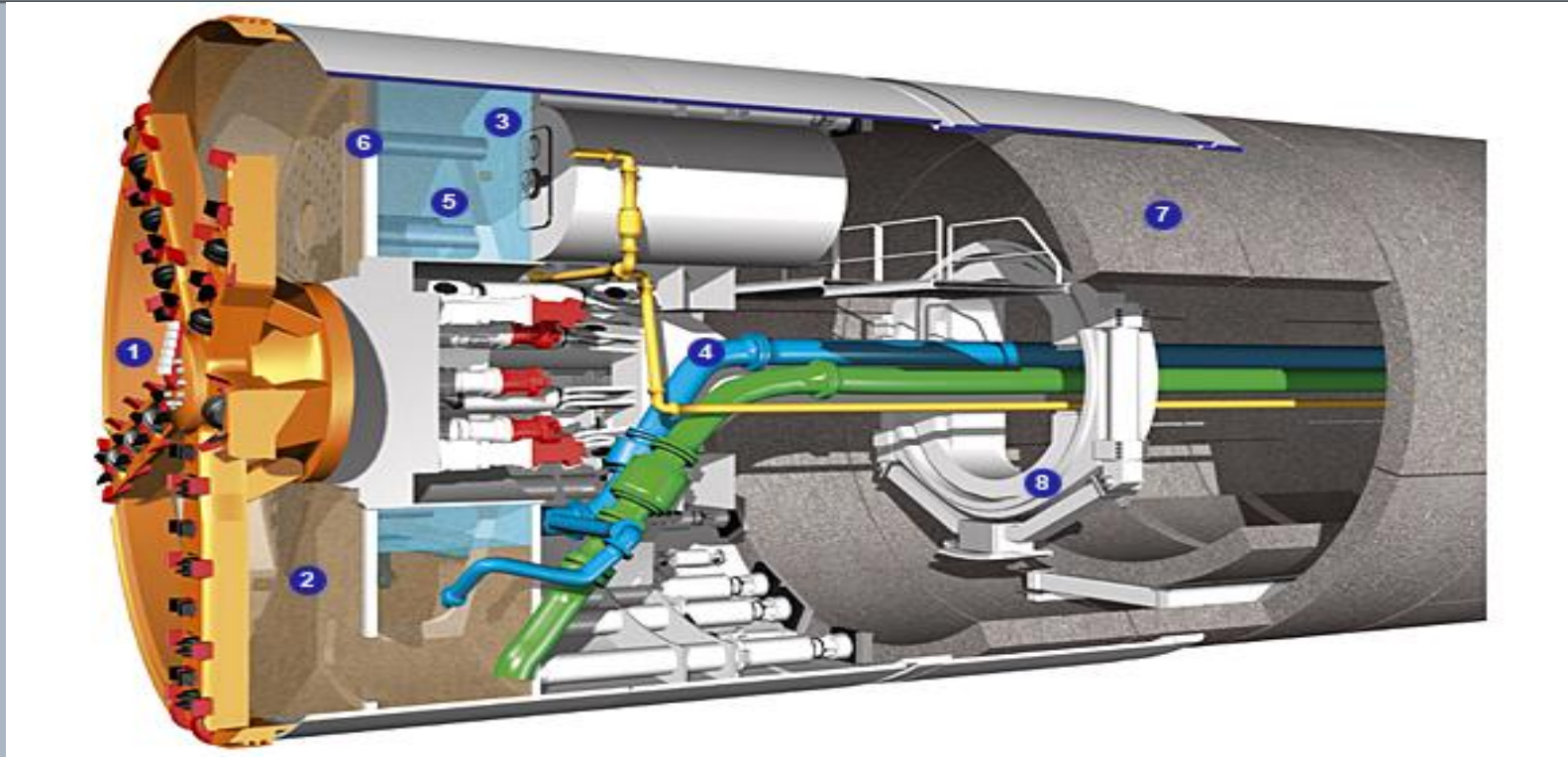
6. Segment Erector

7. Segmental Lining



# Slurry Pressure Balance TBM

(Herrenknecht, 2010)



1. Cutterhead

2. Excavation Chamber

3. Bulkhead

4. Slurry Feed and Return Lines

5. Air Bubble

6. Submerged Wall

7. Segmental Lining

8. Segment Erector